

Dietary Threonine Supplementation Prevents Intestinal Villus Atrophy and Goblet Cell Hypoplasia in Early-Weaned Piglets

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Background

Early-weaned piglets are usually fed animal protein-based expensive starter diets. Corn and soybean meal-based diets are economical. However, gut mucosal atrophy occurs in early-weaned piglets fed soybean meal (SBM)-based weaning diets.

Objective: Our previous studies suggested that dietary supplementation of L-threonine (Thr) at the level of 1.6% (on as-fed basis) to corn and soybean meal-based diets starter diets improved growth performance of the weanling pig. Our aim of this study was to test whether crystalline L-threonine supplementation would prevent gut mucosal atrophy and improve gut functions in early-weaned piglets fed corn and SBM-based solid diets.

Methods and Procedures: A total of 24 Yorkshire piglets were weaned from sows at the age of d 10 and fed a control and a Thr-supplementation diet at *ad libitum* intake for 12 d. The control diet was corn and SBM-based and formulated to meet the NRC (1998) nutrient requirements. The Thr-supplemented diet was formulated similarly as the control diet with added crystalline L-Thr at 1.6% on as-fed basis. Chromic oxide (0.4%) was used as a digestibility marker. After 12 d, plasma and gut tissue samples were taken from the euthanized piglets.

Results:

- Thr supplementation increased plasma Thr and decreased ($P < 0.05$) urea levels. Thr supplementation increased ($P < 0.05$) villus height, total villus to crypt length, villus height to crypt depth ratio and the smooth muscle thickness, but reduced ($P < 0.05$) the crypt depth in both the proximal and the distal small intestinal segments compared with those of the control diet.
- Moreover, Thr supplementation increased ($P < 0.05$) the total mucin-filled goblet cell count in the villus region and reduced ($P < 0.05$) the total mucin-filled goblet cell count in the crypt region compared with those of the control diet.
- Thr supplementation did not improve the whole tract dry matter and crude protein digestibility but increased ($P < 0.05$) the plasma citrulline concentration, consistent with the increased villus epithelial cell mass.

Take Home Messages

- We conclude that Thr supplementation prevents intestinal villus atrophy and goblet cell hypoplasia, which may translate into improved absorptive and mucosal barrier functions in the early-weaned piglet.

Financial support from NSERC, and OMAF-University of Guelph Animal Research Program is appreciated.